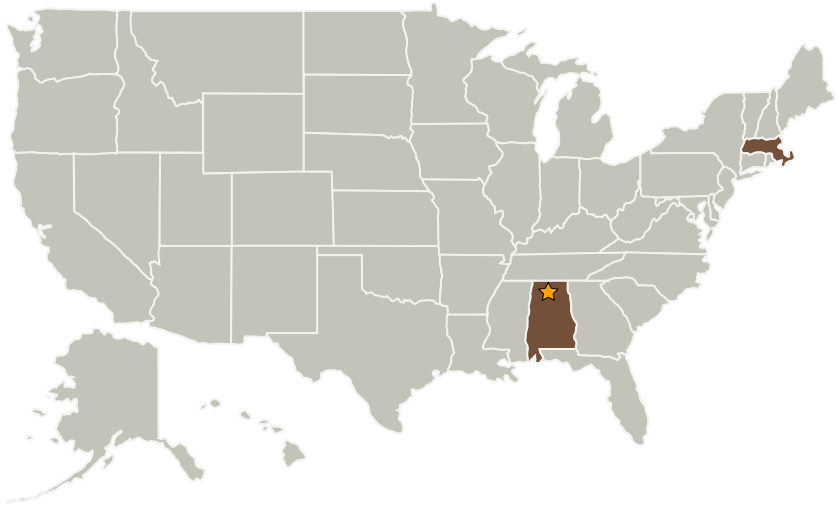
High Burn Rate Hybrid Fuel for Improved Grain Design, Phase I

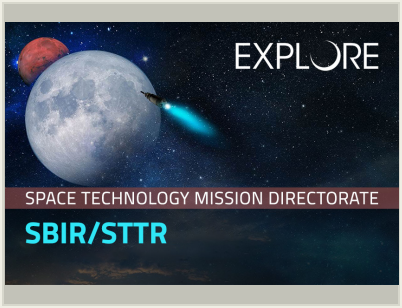
Completed Technology Project (2005 - 2005)

Project Introduction

A novel type of fuel providing high burning rate for hybrid rocket applications is proposed. This fuel maintains a hydrodynamically rough surface to radically enhance convective heat transfer rate, and hence the fuel burn rate. This is achieved by incorporating a particulate fuel material dispersed within a continuum phase polymer matrix. The dispersed fuel material is chosen to transition from solid to gas much more readily than the polymer matrix, and with a particle size scale sufficiently large that the resulting surface voids provide a hydrodynamically rough surface. Combustion of this fuel system thus creates local pockets in the polymer surface, where the particulate fuel is exposed, and maintains the rough surface structure as the dispersed particles are continually exposed. Secondary effects include decreased phase change enthalpy of the mixture, relative to a conventional polymer fuel, and the potential for increased specific impulse by inclusion of high energy compounds as the dispersed phase. This high burn rate fuel will enable increased propellant mass fraction in hybrid rockets, by decreasing the number of ports required to achieve the desired net fuel combustion rate. It also simplifies the technology and retains the relatively high strength and good storage stability of polymeric fuels.

Primary U.S. Work Locations and Key Partners





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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Marshall Space Flight Center (MSFC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Marshall Space Flight Center(MSFC)	Lead Organization	NASA Center	Huntsville, Alabama
Aerodyne Research, Inc	Supporting Organization	Industry	Billerica, Massachusetts

Primary U.S. Work Locations	
Alabama	Massachusetts

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

David B Stickler

Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.1 Chemical Space Propulsion
    - TX01.1.5 Hybrids